**Short Resume/Synopsis of Ph.D. Topic**

**Entitled**

# "STUDIES ON BIOLOGY OF FRESHWATER FISH *CIRRHINUS MRIGALA* (HAMILTON, 1822) AND ITS INTERACTION WITH MICROBES"

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**THE FACULTY OF SCIENCE & TECHNOLOGY,**

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**Short Resume/Synopsis of Ph. D Topic**

# "STUDIES ON BIOLOGY OF FRESHWATER FISH *CIRRHINUS MRIGALA* (HAMILTON, 1822) AND ITS INTERACTION WITH MICROBES".

## 1.A Brief Resume of Proposed Work/ Problem:

*Cirrhinus mrigala* (Hamilton, 1822) is a member of Indian major carp group. The species is of commercial significance due to its aquaculture potential and high consumer preference (P. Mayank, 2000). Mrigal (*Cirrhinus mrigala*), a carp endemic to Indo-Gangetic riverine systems, is one of the three Indian major carp species cultivated widely in Southeast Asian countries. This species has long been important in polyculture with other native species, mainly in India. However, records of its culture are available only from the early part of the 20th century. The traditional culture of the species was restricted to eastern parts of India until the 1950s. The technology of artificial propagation, which assured seed supply in the 1960s, led to the foundation of scientific carp culture. The initially higher growth rate of mrigal, coupled with its compatibility with other carps, has helped in establishing this species as one of the principal component species in pond culture. The species was transplanted in the peninsular riverine systems of India, where it has established itself. Subsequently it has spread over whole of India. In addition, mrigal has become an important component in the fish culture systems of Bangladesh, Pakistan, Myanmar, the Lao People's Democratic Republic, Thailand and Nepal. Mrigal has also been introduced into Sri Lanka, Vietnam, China, Mauritius, Japan, Malaysia, Philippines and the former USSR. Mrigal also forms one of the important components in the sewage-fed carp culture system practiced in an area totalling over 4000 ha in West Bengal, India. In this form of culture, which includes multiple stocking and multiple harvesting of fish larger than 300 g, primary treated sewage is provided to the fish ponds as the main input. Even without the provision of supplementary feed, this system produces 2-3 tonnes/ha/yr. With supplementary feeding, this can be increased to 4-5 tonnes/ha/yr. Hence, there is the need for nutrient supplements in which *C. mrigala* may also play an important role. Keeping in this view, the present study is designed for a detailed investigation of *Cirrhinus mrigala* will be carried out with following objectives:

- To evaluate the water quality of freshwater habitat of *C. mrigala* from Marathwada Region
- To collect *C. mrigala* from local freshwater sources
- To study the taxonomy of *C. mrigala*
- To characterise microbial pathogens affecting the growth and reproduction of *C. mrigala* in healthy and infected fishes.
- To undertake biochemical analyses of infected and healthy tissues of *C. mrigala.*
- Haematological Study

## 2.Introduction to Proposed Research Topic:

Freshwater Fishes has great significance in the life of mankind being an important natural source of protein and providing certain other useful products as well as economic sustenance to many nations. Fish and fishery products playing a significant role in satisfying role in satisfying not only nutritional need of mankind throughout the world. But also contributes much to development through better income. Employment opportunities and increasing returns from resources use. Globally fish provides about 16% of the animal protein consumed by humans. Fish is also available sources of minerals and essential fatty acids to human beings. Mrigal is eurythermal, appearing to tolerate a minimum temperature of 14 ºC. In culture, the species normally attains 600-700 g in the first year, depending on stocking density and management practices. Among the three Indian major carps, mrigal normally grows more slowly than catla and rohu. The rearing period is usually confined to a maximum of two years, as growth rate reduces thereafter. However, mrigal is reported to survive as long as 12 years in natural waters.

In India, total production of fresh water fisheries during 2019-2020 was 104.37 Lakh Tonnes,out of that Maharashtra produced 1.18Lakh Tonnes. Andhra Pradhes &West Bengal are top fresh water fish producing state in India.Their production is 36.1 &16.19 Lakh Tonnes respectively. As Cirrhinus Mrigal belong to one of the Indian major carp. The total production of major carp during 2019-2020 is 59.5 Lakh Tonnes. MaharASHTRA CONTRIBUTES 0.78 Lakh Tonnes. Andhra Pradhes & West Bengal are top in major carp producing state.They contribute 19.98&9.96 Lakh Tonnes respectively. (HANDBOOK ON FISHERIES STATISTICS 2020 GOV.OF INDIA)

## 3.Review of Literature:

Several studies have been conducted on the biology of Indian major carps viz. *Labeo rohita, C. mrigala and C. catla*, to study differentiation among the populations recently (Mir et al., 2012, 2013, 2014) and genetic variation (Zheng, Zheng, Zhu, Luo, & Xia, 1999; Chauhan et al., 2007; Luhariya et al., 2012, 2014; Das et al., 2012; 2014; Hasant, Mollah, & Alam, 2015). Age and growth rates are two attributes of primary importance in accessing fish population and their response to various aspects of management measures (Bhatt et al., 2000). *C. mrigala* (Hamilton, 1822), (Cypriniformes: Cyprinidae) is a warm-water teleost, inhabitant of Indo-Gangetic riverine system spread across northern and central India, and the rivers of Pakistan, Bangladesh, Nepal and Myanmar (Reddy, 1999; Dahanukar, 2010). The most endangered and affected species in the world are freshwater fishes. This decline of freshwater biodiversity is caused by habitat fragmentation and degradation, flow alteration, overharvest,

pollution, and invasive species (Abell et al., 2007). Khan (1972) carried out studies on mrigal, obtained from two different environments i.e., from moats and from the Rivers Ganga and Yamuna around Aiigarh. According to him, morphometric comparisons of different body measurements revealed a significant difference between the fishes from moats and rivers, while the differences between the fishes of different years of sexes were insignificant.

**4.Objectives:**

- To evaluate the water quality of freshwater habitat of *C. mrigala* from Marathwada Region
- To collect *C. mrigala* from local freshwater sources
- To study the taxonomy of *C. mrigala*
- To characterise microbial pathogens affecting the growth and reproduction of *C. mrigala* in healthy and infected fishes.
- To undertake biochemical analyses of infected and healthy tissues of *C. mrigala.*
- Haematological Study.

**5.Methodology to be Used and Adopted**:

The evaluation of water quality, identification of fish, Fish biology, biochemical analyses, haematological study, microbial interaction study will be carried out following standard methods.

Freshwater fish *Cirrhinus mrigala* will be collected from local water bodies in Nanded district and its taxonomic identification will be undertaken following standard keys and methods. Molecular characterization would be done by standard protocol. The genomic sequences of collected fish would be carried out for identification by comparing with the genomic sequence of *C. mrigala* available in Genbank and other databases.

The biochemical analysis of various tissues for proteins, vitamins, lipids, carbohydrates etc. will be performed by using high throughput technologies and standard protocols. Further, isolation and characterization of microbial pathogens will be done.

**Study Area:** *Cirrhinus mrigala* collected from Local Freshwater Habitat of Marathwada Region.

**6.Imporatnce of Study:**

**International Status:**

*Cirrhinus mrigala* is an important fish food in various countries in the world. Mrigal (*Cirrhinus mrigala*), a carp endemic to Indo-Gangetic riverine systems, is one of the three Indian major carp species cultivated widely in Southeast Asian countries. Mrigal is cultured

mainly as a component of carp polyculture systems in the ponds of India and Bangladesh, the major producing countries. The Lao People's Democratic Republics, Thailand, Vietnam, Pakistan, Myanmar and Nepal also use mrigal as one of the principal components in carp polyculture systems. Mrigal has become an important component in the fish culture systems of Bangladesh, Pakistan, Myanmar, the Lao People's Democratic Republic, Thailand and Nepal. Mrigal has also been introduced into Sri Lanka, Vietnam, China, Mauritius, Japan, Malaysia, Philippines and the former USSR

**National Status:**

In India,total production of fresh water fisheries during 2019-2020 was 104.37 Lakh Tonnes,out of that Maharashtra produced 1.18Lakh Tonnes. Andhra Pradhes &West Bengal are top fresh water fish producing state in India.Their production is 36.1 &16.19 Lakh Tonnes respectively. As Cirrhinus Mrigal belong to one of the Indian major carp. The total production of major carp during 2019-2020 is 59.5 Lakh Tonnes. MaharASHTRA CONTRIBUTES 0.78 Lakh Tonnes. Andhra Pradhes & West Bengal are top in major carp producing state.They contribute 19.98&9.96 Lakh Tonnes respectively. (HANDBOOK ON FISHERIES STATISTICS 2020 GOV.OF INDIA)

This species has long been important in polyculture with other native species, mainly in India. However, records of its culture are available only from the early part of the 20th century. The traditional culture of the species was restricted to eastern parts of India until the 1950s. The technology of artificial propagation, which assured seed supply in the 1960s, led to the foundation of scientific carp culture.

**Regional Status:**

Nanded district has a total of 409 reservoirs. In Nanded district 8194 Hectore area is under fishing & 6691 MT is total production of inland fish. This production is contributed by all the talukas of nanded.178.12 178.12 lakhs seeds used for fisheries in nanded district. *Cirrhinus mrigala,* being a suitable culture fish offers a good avenue for aquaculture in the water bodies available in the district.(Fish Production Data of Nanded District, *District Fisheries Development Officer, Assistant Commissioner, Fisheries*)

**7.Scope/ Significance of Study:**

The proposed study will offer an understanding of the biology of *Cirrhinus mrigala*. This understanding of the biology of this fish could help and enable us to plan and execute better culture and management practices in the farms like induced breeding, fish seed rearing

and disease management. This study will also enable us to explore different ways and diverse applications of fish culture in the district.

**8.Proposed Work Plan with Tentative Chapter Scheme:**

The work plan of the proposed study can be summarised into following chapters respectively:

1. Introduction of Fisheries, Significance
2. Review of Literature
3. Physiography
4. Material and Methods
5. Physiochemical Parameters of Water during Study Period
6. Taxonomy of Cirrhinus mrigala
7. Biology of Cirrhinus mrigala
8. Microbial Analysis, Biochemical, Haematological Study
9. Summary and Conclusion
10. Bibliography

**9.Proposed Work Plan:**

**First Year –** Review of literature and methodology appropriate to use and exploration of different sources for the isolation of *Cirrhinus mrigala*. Collection and preservation of fishes.

**Second Year –** Study of biology and growth pattern of collected fish. Its morphological identification and characterization.

**Third Year –** Biochemical analysis and nutrient profile characterization of fish edible flesh. Studying the various fish pathogen and other parameters responsible for declining of the yield and suggesting some alternate solutions to it. Microbial analysis

**Fourth Year –** Compiling the findings and relating it to various applications. Writing thesis, analysing data and submission of thesis.

**10.Expected Outcome:**

From the proposed study, *Cirrhinus mrigala* is expected to yield a high nutritional content profile which can be utilised in diverse ways to serve human welfare in India facing the problems of malnutrition among people under BPL. Research in fish biology can generate new knowledge about developmental characteristics and physiological profile of *Cirrhinus mrigala.* The study of pathogens and factors that lead to decline in yield can help to solve the problem and attain the expected yield in culture. The direction of this research work can be adjusted depending upon the findings from time to time, to attain the best expected result within the schedule.

**11.References:**


1. Abell, R., Allan, J. D., Lehner, B. (2007): Unlocking the Potential of Protected Areas for Freshwaters. – Biological Conservation 134(1): 48-63.
2. Amalie et al., Methods X 7 (2020). Sampling Protocol for the determination of nutrients and contaminants in fish and other sea food – The EAF – Nansen Programme.
3. Chauhan, T., Lal, K. K., Mohindra, V., Singh, R. K., Punia, P., Gopalakrishnan, A., Sharma, P. C.,
4. Dahanukar, N. (2010). Cirrhinus mrigala. The IUCN Red List of Threatened Species 2010: e.T166146A6183216. Retrieved from http://dx.doi.org/10.2305/IUCN.UK.2010 4.RLTS.T166146A6183216.en
5. Das, S. P., Bej, D., Swain, S., Mishra, C. K., Sahoo, L., Jena, J. K., Jayasankar, P., & Das, P.
6. Hasanat, A. M., Mollah, F. A. Md., & Alam, S. Md. (2015). Microsatellite DNA Marker Analysis Revealed Low Levels of Genetic Variability in the Wild and Captive Populations of Cirrhinus cirrhosus (Hamilton) (Cyprinidae: Cypriniformes). British Biotechnology Journal, 5(4), 206-215.
7. J.P. Bhatt, P. Nautiyal, H.R. Singh, Fish. Res., 2000, 44(3), 269.
8. Khan, R,A,, Studies on the biology of some important major carps, D, Phil, Thesis, Department of 1972 Zoology, Aligarh Muslim University, Aligarh 185 p, (Unpubl, MS).
9. Luhariya, R. K., Lal, K. K., Singh, R. K., Mohindra, V., Gupta, A., Masih, P., Dwivedi, A. K., Das,
   molitorella, C. mrigala and Labeo rohita from RAPD. Journal of Shanghai Fisheries University, 8, 215-220.
10. P. Mayank, Comparative study of exotic and Indian fishes with respect of biology from the lower stretch of the Yamuna river at Allahabad. Thesis submitted Nehru Gram Bharti University Kotwa-Jamunipur, Allahabad, Uttar Pradesh 2014, pp 83.
    R., Chauhan, U. K., & Jena, J. K. (2014). Genealogy and phylogeography of Cyprinid fish Labeo
11. Reddy, P V. G. K. (1999). Genetic Resources of Indian Major Carps (FAO Fisheries Technical Paper. No. 387). Rome: FAO.
    rohita (Hamilton, 1822) inferred from ATPase 6 and 8 mitochondrial DNA gene analysis. Current Zoology, 60(4), 460-471.
12. Zheng, G., Zheng, Y., Zhu, X., Luo, J., & Xia, S. (1999). The genetic markers of Cirrhina molitorella, C. mrigala and Labeo rohita from RAPD. Journal of Shanghai Fisheries University, 8, 215-220.
13. (HANDBOOK ON FISHERIES STATISTICS 2020 GOV.OF INDIA)
14. Fish Production Data of Nanded District, *District Fisheries Development Officer, Assistant Commissioner, Fisheries*



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